10/507065
DT09 Rec'd PCT/PTO 08 SEP 2004

Process and Unit for Producing an Aluminium Strip with Textured Surface

The invention relates to a process for producing a strip of aluminium or an aluminium alloy with a textured surface, whereby a cold rolled strip is passed through the roll gap of two textured rolls bearing a roughness pattern and the roughness pattern is transferred to the surface of the strip as a result of the force of the textured roll acting on the strip. The invention also relates to a unit for producing a cold rolled strip of aluminium or an aluminium alloy having a textured surface using a cold rolling mill.

In the automotive industry strips and sheets of aluminium alloys are employed for the manufacture of bodywork parts, whereby the sheets are shape-formed by deep drawing or stretch drawing. Lubricants have to be employed to carry out this deep drawing and other shape-forming steps. By pre-coating the strips or sheets in the rolling mill not only is the forming procedure simplified, but also optimal protection during transportation achieved.

In a procedure commonly used today the strip manufacturer coats the cold rolled strip with an oil or a water-soluble dry lubricant and the prepared strip supplied to the sheet-forming company for the purposes of deep drawing.

In the case of an aluminium strip that has been produced in the normal manner using work rolls with a roll finish corresponding to a mill-finish surface texture, the lubricants exhibit relatively poor adhesion and distribution.

The adhesion and distribution properties of dry lubricants on the strip surface can be markedly improved by providing the surface of the strip with a roughness pattern. To that end the roughening of the strip surface is effected by

transferring the roughness pattern on the work rolls to the surface of the strip during cold rolling of the strip.

Today, the roughness patterns provided on the surface of the aluminium strip to improve the adhesion and distribution of a dry lubricant there are produced by work rolls which are roughened e.g. by electrical discharge texturing (EDT), by electron beam texturing (EBT) or by the PRETEX method. All of these methods of roughen-ing result in a surface texture with irregularly distributed, closed "lubricant pockets".

The above mentioned roughness patterns are produced on the surface of the strip in an additional cold rolling pass using a roll pass involving a small thickness reduction approx. 0.05 to 15%. In practice this additional cold rolling pass incurs correspondingly greater production costs. In addition, in order to produce the roughness pattern, it is necessary to change the work rolls that have a conven-tional roll-grind pattern for textured rolls.

The object of the present invention is to provide a process and a unit of the kind described at the start, by means of which the production costs for manufacturing textured strips can be reduced. A further objective is to avoid the loss of capacity on a production unit caused by an additional texturing roll pass.

The object of the invention with respect to the process is achieved by way of a unit in which, immediately after the cold rolled strip emerges from a cold rolling mill, it is passed through the roll gap of two texturing rolls and the textured strip is coiled.

With this process it is possible to dispense with a separate texturing roll pass and consequently save one roll pass compared with the state of the art method.

In a preferred version of the process according to the invention the cold rolled strip is drawn through the roll gap and the texturing rolls turned by the tension on the strip. Of course it is also possible to actively drive the texturing rolls.

In order to adjust the thickness as uniformly as possible over the whole breadth of the strip, the texturing rolls are preferably set at a constant roll force.

To endow the strip surface with the above mentioned property whereby it acts as substrate for a dry lubricant, the texturing rolls are - to advantage - roughened using electrical discharge texturing (EDT).

It has been found that the process according to the invention is also suitable for smoothing cold rolled strips. To that end it can also be proved advantageous to provide the texturing rolls with the conventional, simple roll grind that results in the so called "mill finish" surface quality. The rolls are only ground over their outer surface direction, i.e. the roll grind comprises a plurality of parallel grooves distrib-uted over the outer surface of the rolls.

The objective of the invention with respect to the unit is achieved in that a texturing roll stand with texturing rolls is provided immediately after the cold rolling mill in the direction of movement of the strip. The texturing rolls may be joined up to a roll drive facility.

Preferred is an arrangement in which the texturing rolls in the texturing roll stand are supported by intermediate rolls, which are in turn supported by backing rolls. The backing rolls may be arranged in several sets of rolls across the width of the intermediate rolls.

The backing rolls are preferably joined up in co-action to hydraulic pistons set at a constant force.

Because of its relatively small size, the texturing roll stand may be installed in the structure of the cold rolling mill.

Further advantages, features and details of the invention are revealed in the following description of preferred exemplified embodiments and with the aid of the drawing; this shows schematically in

Fig. 1: the end view of a unit for producing a strip with a textured surface;

Fig. 2: the front elevation of a texturing roll stand;

Fig. 3: the cross-section through the roll arrangement of a roll stand shown in figure 2.

A unit for producing an aluminium strip with a textured surface according to Fig. 1 comprises a cold rolling mill 17 with two work rolls 18, 20 forming a roll gap 19 and two backing rolls 22, 24 supporting the work rolls. The work rolls 18, 20 and the backing rolls 22, 24 are mounted in a mill stand 26 in a known manner.

Likewise installed in the stand 26 is a texturing roll stand 28 which is smaller than the cold rolling mill 17.

As shown in figures 2 and 3, the texturing roll stand 28 exhibits two texturing rolls 38,40 which delimit a roll gap 39 and are supported by a pair of intermediate rolls 42, 44. Each pair of intermediate rolls 42, 44 is supported by five sets of three backing rolls 46, 48. The backing rolls 46, 48 are mounted in beams 50, 52 which extend over the width of the rolls. The upper beam 50 is supported by an upper part 54

of the roll stand frame via hydraulic pressure type pistons 58, the lower beam 52 lies directly on a lower part 56 of the roll stand frame. Both parts 54, 56 of the roll stand frame may be moved towards and away from each other by means of hydraulic raising or lowering pistons 60, 62 i.e. the roll gap 39 can be opened as desired viz., when no texturing pass is required, or when the necessary dimension for a texturing pass is being adjusted. The roll force is adjusted via the hydraulic pistons 58 and thus the reduction in strip thickness during the texturing roll pass. The roll force is set by via the hydraulic compressive piston 58 and with that the reduction in thickness of the strip during the texturing pass.

In order to produce the surface texture pattern, a cold rolled strip coiled onto a reserve roll 14 is passed over a deflection roll 16 then fed in the rolling direction x to the roll gap 19 of the cold rolling mill 17. After it emerges from the roll gap 19, the strip 12 enters the roll gap 39 of the texturing mill stand 28. On leaving the texturing mill stand 28 the strip 12 is deflected around two further deflection rolls 30, 32 and coiled onto a spool 34. The thickness of the strip is checked by a thick-ness measuring device 36 situated between the texturing mill stand 28 and the second deflection roll 30. At the same time, the second deflection roll 30 serves to check the flatness of the textured strip 12.

The work rolls 18, 20 of the cold rolling mill 17 are driven and the strip 12 is drawn into the roll gap 19 by the rolls themselves. The texturing rolls may be driven in an active manner or may not be driven. If the texturing rolls 38, 40 are not driven, then the strip 12 must be drawn through the texturing roll stand. This is done by the driven spool 34. The braking action of the texturing rolls 38, 40 results in a stress- regulating effect, which leads to better flatness in the textured strip 12.

The diameter of the texturing rolls 38, 40 is of course smaller than the diameter of the driven work rolls 18, 20 of the cold rolling mill 17. This produces a better texture in the strip surface with the result that a smaller reduction in thickness is necessary. The diameter of a texturing roll is e.g. around 350 mm.